

P-2.2 Apply formulas for velocity or speed and acceleration to one and two-dimensional problems

Revised Taxonomy Level 3.2 C_A Apply (implement) procedural knowledge

Key Concepts

In physical science students solved linear problems involving speed, velocity and acceleration.

- ❖ Students used the equation $v = d/t$ to solve for any of the three variables when given the other two.
 - Students applied the equation to solve for either speed or velocity depending upon the context of the problem.
 - Students differentiated average velocity (or speed) from instantaneous velocity (or speed).
- ❖ Students distinguished initial velocity from final velocity and used the equation $(v_i + v_f)/2$ to find the average velocity of objects accelerating at a constant rate.
- ❖ Students used the equation $a = (v_f - v_i)/t$ to solve for acceleration (only, not velocity or time)

With this foundation, physics students can scope of these types of problems to include motion in two dimensions, as well as solving for other quantities.

As Physics for the Technology classes and traditional college prep classes will have different curricula based on the choices that are made for standards six through ten, the scope of the core curriculum should vary as well. The emphasis of topics within the core standards will depend on subsequent topics to be addressed.

It is essential for all physics students to

- ❖ Analyze the relationships among speed, velocity, and constant acceleration
- ❖ Understand the interrelationship between the conceptual understanding of each type of motion, and the mathematical formulas and graphical representations used to describe it.
- ❖ Solve problems involving velocity, speed, and constant acceleration
 - Graphically, using vector addition
 - Analytically, using mathematical equations
 - ◆ For constant velocity
 - $v = d/t$
 - ◆ Average velocity (regardless of the type of motion)
 - $v_{ave} = \Delta d / \Delta t$
 - ◆ For constant acceleration
 - $a = (v_f - v_i)/t$
 - $d = (v_{ave}) t$
 - $v_{ave} = (v_i + v_f)/2$

College prep differentiation

- ❖ Solve multi-step problems
 - Analytically
 - ◆ Using vector analysis

- ◆ Using algebraic equations
 - Solve for any of the variables in the equation
 - include the following relationships:
 - * $d = (v_i t) + \frac{1}{2} a t^2$
 - * $v_f = \sqrt{v_i^2 + 2ad}$

Assessment

As the verb for this indicator is implement (apply), the major focus of assessment will be for students to show that they can “apply a procedure to an unfamiliar task”. The knowledge dimension of the indicator is “knowledge of subject-specific techniques and methods” In this case the procedure is the application vector addition, the equation for constant velocity, and equations which represent accelerated motion. The unfamiliar task should be a novel word problem or laboratory investigation. A key part of the assessment will be for students to show that they can apply the knowledge to a new situation, not just repeat problems which are familiar. This requires that students have a conceptual understanding of each of the variables as well as mastery of the skills required to implement the mathematical equation or in order to solve the problem.